

# Solving Quadratic Equations by Completing the Square

Ex) Solve using the square root property

Square Root Property

If  $a^2 = b$ , then  $a =$

a.  $x^2 = 45$

b.  $5x^2 - 55 = 0$

c.  $(x+2)^2 = 18$

d.  $(3x-1)^2 = -4$

Ex) Solve by completing the square

a.  $x^2 - 8x - 1 = 0$

Step 1. Move the constant to the other side (leaving a space where it was)

Step 2. Fill in the space w/ the value  $(\frac{b}{2})^2$ . \*Don't forget: what we do to one side we must do to the other\*

Step 3. Factor the left hand side.

Step 4. Solve using the square root property.

$$b. y^2 - 5y + 2 = 0$$

$$c. 5x^2 - 10x + 2 = 0$$



Ex) Use the formula  $A = P(1+r)^t$  to find the interest rate  $r$  if \$1600 compounded annually grows to \$1764 in 2 years.

$A$  = future amount

$P$  = principal

$r$  = annual interest rate

$t$  = time in years

## Solving Quadratic Equations using the Quadratic Formula

If  $ax^2 + bx + c = 0$ , then

$$x =$$

Ex) Solve using the quadratic formula

a.  $2x^2 - 6x = 1$

b.  $\frac{1}{6}x^2 - \frac{1}{2}x - 1 = 0$

What are these solutions anyway?!

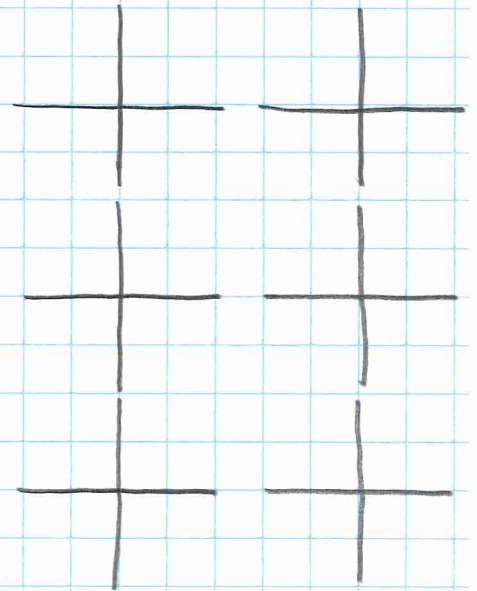
## Discriminant -

Tells us the type and number of solutions for a quadratic

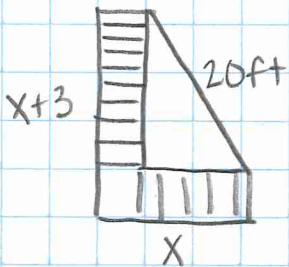
$$b^2 - 4ac > 0$$

$$b^2 - 4ac = 0$$

$$b^2 - 4ac < 0$$



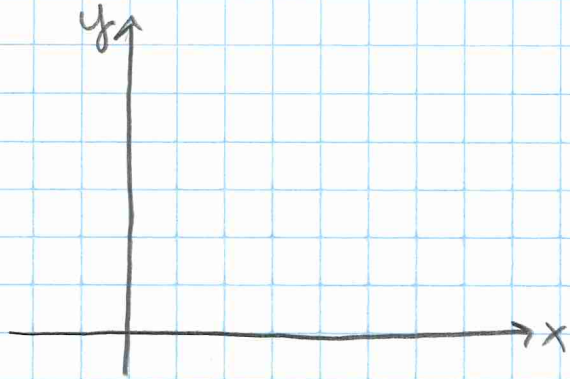
Ex) Given the diagram, the the distance a person saves by cutting across the field instead of going around.





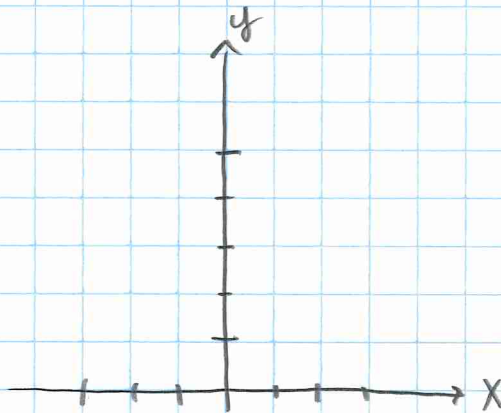
# Quadratic Functions and Their Graphs.

$$f(x) = ax^2 + bx + c = a(x-h)^2 + k$$



Ex) Graph  $f(x) = x^2$

x	y
-2	
-1	
0	
1	
2	



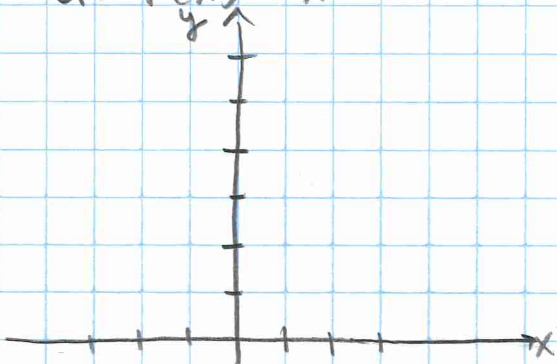
~~Vertical Shifts~~

~~$f(x) = x^2 + k$~~

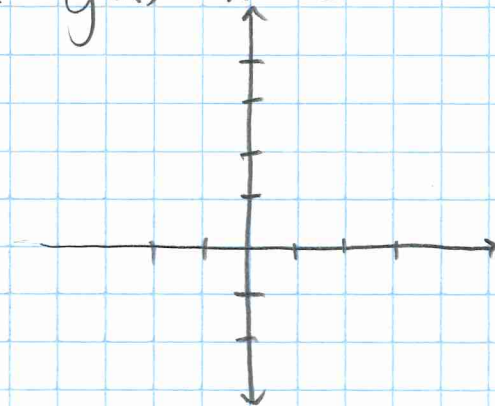
~~$f(x) = x^2 - k$~~

Ex) Graph

a.  $f(x) = x^2 + 1$



b.  $g(x) = x^2 - 2$



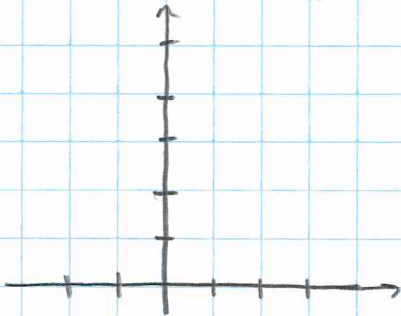
~~Horizontal Shifts~~

~~$f(x) = (x - h)^2$~~

~~$f(x) = (x + h)^2$~~

Ex) Graph

a.  $f(x) = (x - 1)^2$

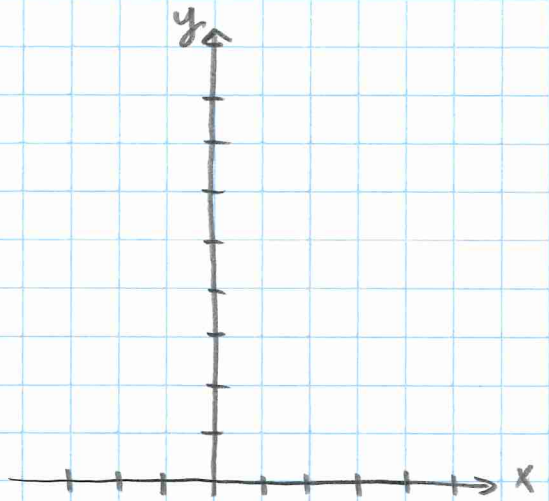


b.  $g(x) = (x + 2)^2$





Ex) Graph  $f(x) = (x-2)^2 + 3$



~~Stretches/compressions + Reflections~~

~~$f(x) = ax^2$~~

~~Reflection~~

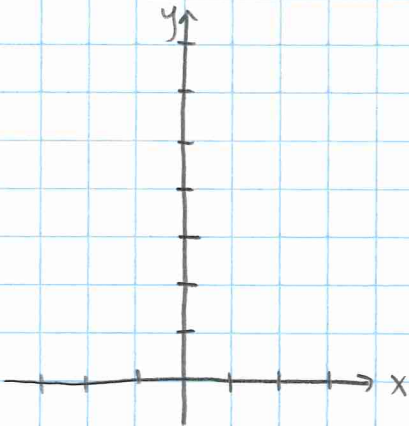
~~$a > 0$~~

~~$a < 0$~~

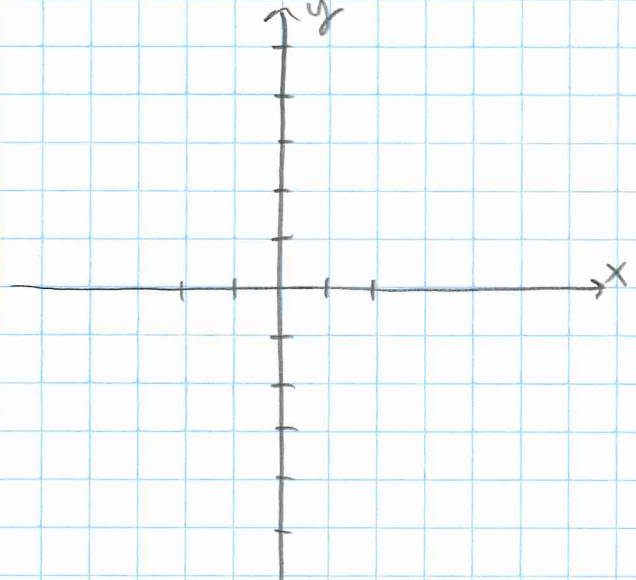
~~stretch/compression~~

Ex) Graph

a.  $f(x) = 2x^2$



b.  $h(x) = -\frac{1}{2}x^2$



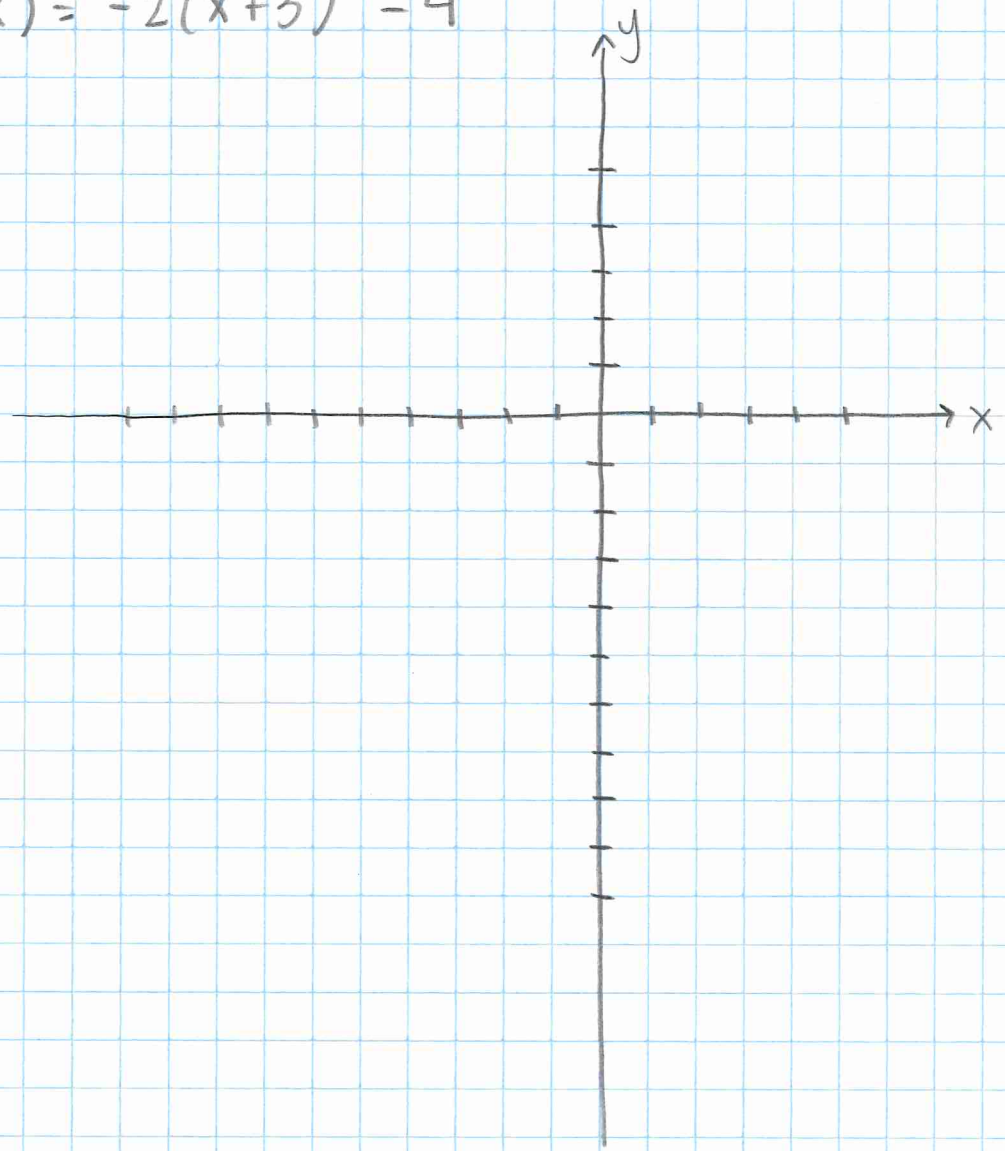
# ~~Ex) Graphing a sequence of transformations~~

1.

2.

3.

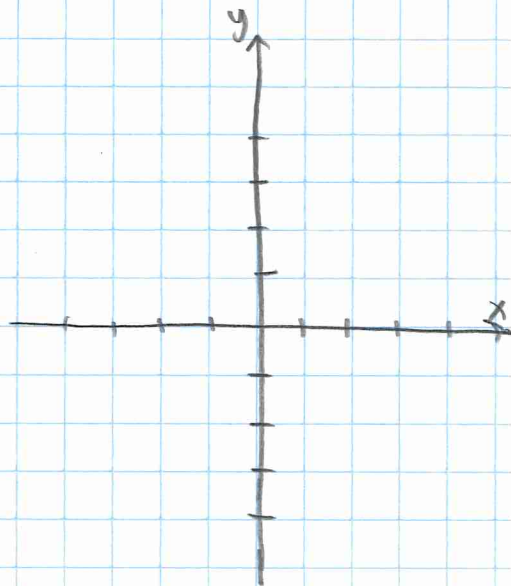
$$f(x) = -2(x+3)^2 - 4$$



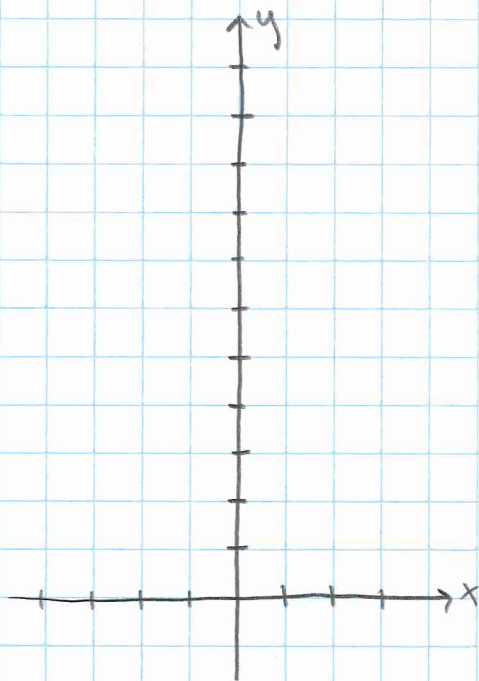
## Further Graphing of Quadratic Functions

Ex) Graph the quadratic in the form  $f(x) = ax^2 + bx + c$  and graph the vertex:

a.  $g(x) = x^2 - 2x - 3$

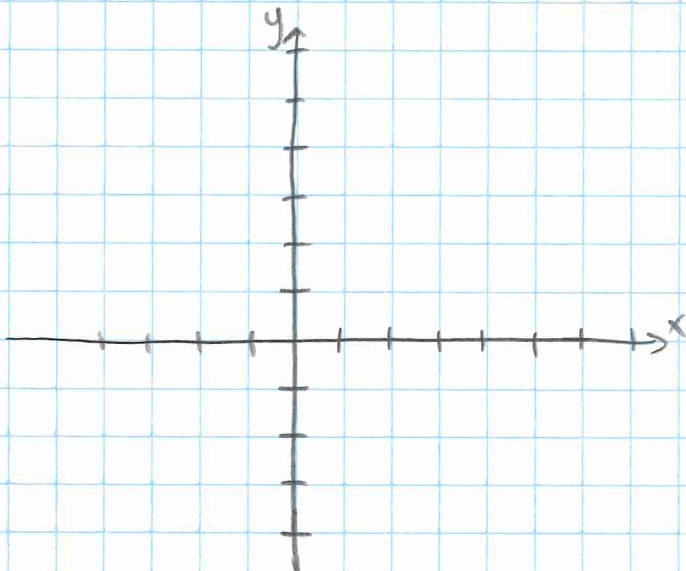


b.  $h(x) = 2x^2 + 4x + 3$





$$c. g(x) = -x^2 + 4x - 1$$

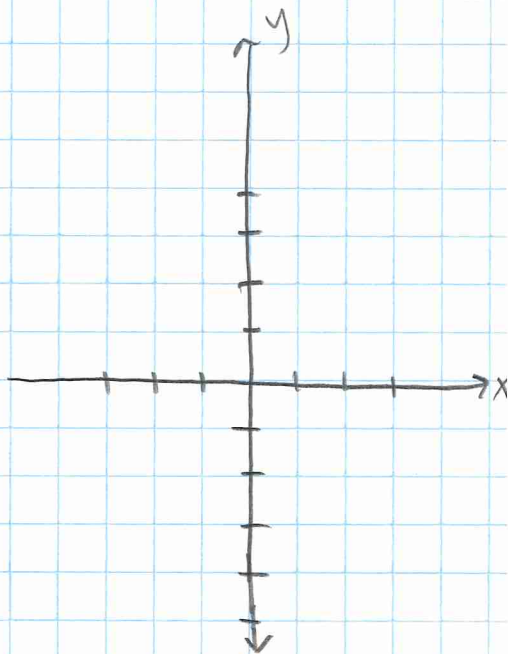


If  $f(x) = ax^2 + bx + c$ , then

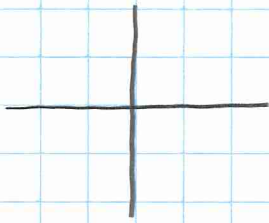
Vertex:

\*

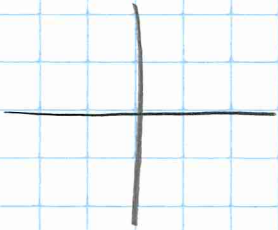
EX) Graph  $f(x) = x^2 + 2x - 3$



If  $a > 0 \rightarrow$  graph opens \_\_\_\_\_



If  $a < 0 \rightarrow$  graph opens \_\_\_\_\_



Ex) A projectile is fired straight up from the ground with an initial velocity of 96 ft/sec. Its height  $h$  in feet after  $t$  seconds is given by

$$h(t) = -16t^2 + 96t$$

Find the maximum height.

Ex) The Utah Ski club sells calendars to raise money. The profit  $P$  from selling  $x$  calendars is given by

$$P(x) = 360x - x^2$$

a. Find the # of calendars that need to be sold to maximize profit.

b. What is the maximum profit?

Ex) I want to enclose a rectangular garden. If I only have 200 ft of fencing, what is the maximum area that can be enclosed?